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## Volume 3 Ferro- and Antiferroelectric Substances

by Toshio Mitsui and

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	Pure compound	s of simple typ	e				
٧r.	7A-1 Bi <sub>8</sub> TiNbO	1					
a	Dielectric anoma 1960.	ly associated wit	th a phase transition was reported by ISMAILZADE in	6011			
b	phase	п	I				
	state		Pa)	*)6011			
	crystal system	orthorhombicb)	tetragonal <sup>b</sup> )	b)62S17			
	space group	Fmm2-C <sub>2</sub>	I4/mmm-D <sub>th</sub>				
	<del>0</del> *	900 · · ·	950 °Cb)				
	$\varrho = 6.4 \cdot 10^3  \mathrm{kg}$	m-3.		62517			
		5.44  Å, c = 25.1					
\$	Temperature de Linear thermal	pendence of latti expansion: Fig. 8	ce parameters: Fig. 868.				
5a	Dielectric consta			61514			
	$\kappa \approx 100$ at RT. The dielectric co	nstant was not	measured in the vicinity of the transition point be-	61511			
	cause of high co	anductivity. Ex	trapolation of the Curie temperatures of the solid dielectric measurements indicates a transition tem-				
	perature betwee	n 900° and 950°	C for Bi <sub>3</sub> TiNbO <sub>9</sub> .				
	-						
Vr.	7A-2 Bi <sub>3</sub> TiTaO <sub>6</sub>						
ia			of Bi <sub>3</sub> TiNbO <sub>3</sub> was reported by Subbarao in 1962.	62517			
b	phase mansimon	II I	I	02211			
Ĭ	state		P				
		orthorhombic	tetragonal				
	crystal system						
	space group	Fmm2-C <sub>27</sub> 870	14/mmm-D <sub>40</sub>	62517			
	05 103 1		•	02577			
	$\varrho = 8.5 \cdot 10^3 \text{ kg m}^{-3}$ . a = 5.39  Å, b/a = 1.007, c = 25.1  Å at RT.						
		xpansion; see Fig. 869.					
<u> </u>		expansion: see F	ig. 607.	l			
	Linear thermal	expansion: see F ant: $\kappa \approx 140$ at 1		62517			
	Linear thermal			62S17			
5a	Linear thermal	nnt: x ≈ 140 at ]		62517			
4 5a Nr. 1a	Linear thermal Dielectric consta  7A-3 CaBi <sub>8</sub> Nb <sub>2</sub> C	nnt: x ≈ 140 at l		62S17			
Sa Nr. 1a	Linear thermal Dielectric consta  7A-3 CaBi <sub>8</sub> Nb <sub>2</sub> C  Dielectric anomin 1960.	nnt: x ≈ 140 at l	RT.				
5a Nr.	Linear thermal Dielectric consta  7A-3 CaBi <sub>2</sub> Nb <sub>2</sub> C  Dielectric anomin 1960. phase	nnt: x ≈ 140 at l  O  o  ally associated wi	RT. th a phase transition was discovered by Ismailzade				
Sa Nr. 1a	Dielectric constant  7A-3 CaBi <sub>8</sub> Nb <sub>2</sub> C  Dielectric anomin 1960.  phase  state	nnt: x ≈ 140 at l  O  Raly associated wi	RT.  th a phase transition was discovered by Ismailzade  I P				
Sa Nr. 1a	Linear thermal Dielectric consta  7A-3 CaBi <sub>8</sub> Nb <sub>2</sub> C  Dielectric anomin 1960. phase state crystal system	nnt: x ≈ 140 at 1  O <sub>0</sub> ally associated wi  II  orthorhombic	th a phase transition was discovered by Ismailzade  I P tetragonal				
Sa Nr. 1a	Linear thermal Dielectric consta  7A-3 CaBi <sub>2</sub> Nb <sub>2</sub> C  Dielectric anomin 1960. phase state crystal system space group	ant: x ≈ 140 at 1  O <sub>9</sub> ally associated wi  II  orthorhombic  Fmm2-C <sub>27</sub>	th a phase transition was discovered by Ismailzade  I P tetragonal I4/mmm-D <sub>th</sub>				
Sa Nr. 1a	Linear thermal Dielectric consta  7A-3 CaBi <sub>8</sub> Nb <sub>2</sub> C  Dielectric anomin 1960. phase state crystal system space group  6	ant: x ≈ 140 at 1  O   ally associated wi  II  orthorhombic  Fmm2-C <sub>zv</sub> 62:	th a phase transition was discovered by Ismailzade  I P tetragonal	6011			
Sa Nr. 1a	Linear thermal Dielectric constant TA-3 CaBi <sub>8</sub> Nb <sub>2</sub> C Dielectric anomin 1960. phase state crystal system space group $\Theta$ $\rho = 5.0 \cdot 10^3$ kg	ant: x ≈ 140 at 1  O <sub>9</sub> ally associated wi  II  orthorhombic  Fmm2-C <sub>27</sub> 62: m <sup>-3</sup> .	th a phase transition was discovered by Ismailzade  I P tetragonal I4/mmm-D <sub>th</sub> 5°C	6011			
Sa Nr. 1a	Linear thermal Dielectric constant TA-3 CaBi <sub>8</sub> Nb <sub>2</sub> CaBi <sub>8</sub> CaBi <sub>8</sub> Nb <sub>2</sub> CaBi <sub>8</sub> Nb <sub>2</sub> CaBi <sub>8</sub> CaBi	ant: $\kappa \approx 140$ at 1  O <sub>0</sub> aly associated wi  II  orthorhombic  Fmm2-C <sub>2v</sub> 62:  m <sup>-3</sup> .  = 1.006, $c = 25$	th a phase transition was discovered by Ismailzade  I P tetragonal I4/mmm-D <sub>th</sub> 5°C	60I1 60I1			

	404								
Tab.	104. Tempe	rature dep	endence of	the lattice	paramete	rs of CaBi	Nb <sub>2</sub> O, and	CaBi <sub>2</sub> Ta <sub>2</sub> O <sub>9</sub>	[60]1]
T	20	100	150	200	250	300	350	400	°C
	1 5445			CaBi <sub>2</sub>	Nb <sub>2</sub> O,		· · · · · · · · · · · · · · · · · · ·		<u>'                                     </u>
a b	5.442 5.482 <sub>5</sub>	_	5.453	_	5.458		5.465	1 -	Į Å
C	24.920		5.484	-	5.487	1	5.491	-	Å
b/a	1.0075	_	24.955 1.0056	_	24.990		25.035	_   _	Å
V	743.5	_	746.0	_	1.005 748.5	3 -	1.0047 751.0	'   -	Å*
		'	, , , , ,	CaBi,	•	1	1 751.0	1 —	A*
a b	5.435	5.438		5.444	-	5.452	2 1 —	5.464	ı A
6	5.468 <sub>5</sub> 24.970	5.471	-	5.475 <sub>6</sub>	-	5.479	i i	5.482 <sub>6</sub>	Ā
b/a	1.006	24.980	-	25.015	_	25.040	)	25.060	Å
v	742.0	1.006 743.2	_	1.005	-	1.005	5   -	1.003 <sub>8</sub>	١. ا
T	450	T		745.6		748.0		750.6	ų
	1 430	500	550		75	600	650	700	•c.
а	5.480	. 5 405		CaBi,1					
ь	5.496,	5.485 5.501 <sub>a</sub>	5.48	- 1	495,	- 1	5.502	5.504	Å
c	25.070	25.080	5.50 25.09		503,	-	5.502 <sub>s</sub>	5.504	Ā
b/a	1.0036	1.0029			0015	_	25.125 1.000	25.140 1.000	Å
V	755.0	756.8	758.0	759.3		_	760.7	761.6	Å۶
_	i			CaBi <sub>2</sub> 7	Γa <sub>•</sub> O <sub>•</sub>	•			
a b	_	5.470	5.47		-	5.479	5.484	- 1	Ā
c	_	5.483,	5.48	1	-	5.479	5.484	-	Å
b/a		25.070 1.002 <sub>s</sub>	25.08		-	25.085	25.105	-	Å
V	_	751.9	752.8	Z <sub>q</sub>	٠   ,	1.000 30.0	1.000	-	Å۵
Nr. 7	A-4 CaBi, T		1 /32.0	, –	- , ,	30.0 j	755.0	_ '	A,
1a	Dielectric and in 1960.		iated with	a phase tran	sition was	discovered	by Tewayraa	DE 60I1	
ь	phase					disco relog	Oy ISBRILZA	DE	- 1
	state		<u> </u>		_			6011	- 1
	crystal system			P	_			İ	- 1
	space group			tetragonal	_				
ľ	Θ group	Fmm		/mmm-D <sub>4h</sub>	_				
.	$\varrho = 7.5 \cdot 10^{a}$	kg m-3	575 °C					2074	
	a = 5.428  A,	b/a = 1.006	c = 24.90	À at RT.				60I1 61S11	
4	remperature	dependence	of lattice	parameter: s	see Tab. 10	)4.		-	
5a	Protectific COI	nstant: Fig.	872.				<del></del>		
Nr. 7	A-5 SrBi <sub>2</sub> NI	$O_1O_0$						ı	
1a	Dielectric and in 1961.	omaly associ	ated with a	phase trans	sition was	discovered	by Smolensi	KII 61511	
b	phase	11		I			·		7.
	state				-	. •			- 1
	crystal system	m orthorh	ombic	tetragonal	-				
	0		420		-			61511	
	$\varrho = 6.9 \cdot 10^{\circ}$	ka m-20)	440*) (	C			•	a)62S17	
	$\mu = 5.506 \text{ A},$	b/a = 1.000	c = 25.05	Å at RT.				62515	
5a	Dielectric con $x = C/(T - C)$	nstant · Fig	072 . 4	00 4 70 70	200 °C		····		$\dashv$
7a	Piezoelectric	$ity: d_{33} = 1.$	0 · 10-11 C	ν-1.	. 390 °C.			62517	
			0	•				1 02317	1

r. 7A-6 SrB	i.T2.O.			
		C-B: To O wa	s reported by Smolenskii in 1961.	61511
	ctricity ii	II	I	61511
phase	-	F F		
state		orthorhombic	tetragonal	
crystal s	ystem	310		
6	1		C	61511
$\varrho = 7.5$	· 10³ kg n	$n^{-3}$ . = 1.000, $c = 25$	000 Å at RT.	62S15
		nt: Fig. 874. × 9		
Dielectri $\kappa = C/U$	$T - \Theta_n$ ).	$C = 2.0 \cdot 10^6  ^{\circ}$	$\frac{1}{C}$ , $\Theta_{\rm p} = 190$ °C.	62517
Spontan	eous pola	rization: Ps =	5.8 · 10 <sup>-2</sup> C m <sup>-2</sup> at 25 °C.	62S17
Piezoele	ctric cons	$stant: d_{83} = 2.3$	· 10 <sup>-11</sup> C N <sup>-1</sup> .	62S17
r. 7A-7 Ba				
			h a phase transition was discovered by Sмо́LENSKII	61511
phase	1	II i	Ī	
	<del></del>		P	
state		orthorhombic	tetragonal	
crystal s	system	210	°C	61511
θ		200		a)62S17
$\varrho = 6.3$	· 10* kg	m <sup>-3</sup> .	E 60 Å at PT	62515
a = 5.5	54 A, b/a	= 1.000, $c = 2$ nt: Fig. 875. $\times$	3.00 A at K1.	62517
a Dielecti in 1961.	ric anoma	aly associated wi	th a phase transition was discovered by Smolenskii	61511
b phase		II	<u> </u>	1
state			P	61511
crystal	system	orthorhombic		a)62S17
0			ρ) °C	61511
Accord	ing to [61	<i>1511</i> ] ⊖ is 70 °C		01311
$\varrho = 8.4$	1. 10° kg	$m^{-3}$ . $a = 1.000, c = 2$	25.50 Å at RT.	62515
a = 3.	ric const	ant: Fig. 876. ×	= 400 at RT.	62517
Nr. 7A-9 P	ric anom	alv associated v	with a phase transition in PbBi <sub>2</sub> Nb <sub>2</sub> O <sub>9</sub> was reported	5958
ia Dielect	OLBNSKII	in 1959.		
b phase		II		
state			P	5958
	system	orthorhombic	tetragonal	77.50
9		52 55	26 °C 50a) °C	e)61S15
$\varrho = 7$	6 · 10° kg	1	•	62S15
		re: Fig. 877.		
4 Tempe	erature de	ependence of lat	tice parameters: Fig. 878.	-
5 Dieles	tric const	bant Fig 879, 1	s = 170 at RT. °K, Θ <sub>p</sub> = 510 °C.	62517
7a Piezoe	electric co	onstant: $d_{33} = 1$	.5 · 10 <sup>-11</sup> C N <sup>-1</sup> .	62517
(			D bee Nomuse Nakamusa	

1a		was reported by S	SUBBARAC	o*) and Smolenskiib) independently in 1961.	
b		II	I	<del></del>	Þ)61S11
	state	- F	P		
	crystal system	orthorhombic	tetrag	onal	61515
	Θ	430	<b>℃</b>		61511
		a = 1.000, c = 2			62515
5a	Dielectric const $\kappa = C/(T - \Theta_{p})$	ant: Fig. 880. $\kappa = 3.7 \cdot 10^4$ °C	= 180 at $C$ , $\Theta_p = 3$	RT. 325 °C.	62517
7a	Piezoelectric co	$nstant: d_{33} = 5.$	10-12 C N	-1	62517
٧r	. 7A-11 Bi <sub>4</sub> Ti <sub>3</sub> O <sub>12</sub>				
1a	T	· · · · · · · · · · · · · · · · · · ·	reported	by Van Ultert et al. in 1961.	44770
ъ		II II	reported	I	61 V 2
	state	F	·		(47/2)
		monoclinic	2)*	<del></del>	61V2
	crystal system	(pseudo-orthorh		tetragonal	a)67C6
	0		675	°C	
	Dorth = 5.448 A, Relations betwee P <sub>s</sub> lies in a direct	$c_{orth} = 32.85 \text{ A a}$ en crystallograph: tion tilted at app	t RT. ic axes: I roximate	th the lattice parameters: $a_{\text{orth}} = 5.411 \text{ Å}$ , Fig. 881. ly 7° (or less) from the major crystal surprhombic $b - c$ plane.	6706
2a				consisting of 100 Bi <sub>2</sub> O <sub>3</sub> and 5 TiO <sub>2</sub> (weight	67C6 61 V 2
3	Crystal structure	e: Fig. 882.			<u> </u>
4	Temperature de Thermal expans	pendence of lattic	e parame	ter: Fig. 883.	
5a	Dielectric consta				
С	L vecouning to lo	al. measured P <sub>s</sub> 1.99 · 10 <sup>-2</sup> C m <sup>-3</sup> .	eous pola	by applying a field parallel to the $c_{orth}$ $13 \cdot 10^4 \ V \ m^{-1}$ . arization lies in the pseudo-orthorhombic $\cdot 10^{-2} \ C \ m^{-2}$ .	63T1 67C6
7		stant: $d_{33} = 2.0$ .			61517
)	Conductivity: se	е			64P3
la	Domain structur Domains have b	e: see een observed by p	olarized	light.	64P3 66C7
b	Switching: Fig. 8 See also Fig. 892	<b>388, 889</b> .			66P6
7	Twinning structi	ire: see			64P3
lr.	7A-12 BaBi,Ti,N	PO <sup>13</sup>			
a	Dielectricanomal	y associated with a	phase tra	ansition was reported by SUBBARAO in 1961.	61515
ь	phase	II	1	1	1
	state			P	
1	crystal system	pseudo-tetragor	al to	etragonal	61515
ļ	$\Theta = 3.874 \text{ Å, } c =$	33.70 Å at RT	270 °C		
- 1				'	
] Jr.	7A-13 PbBi.Ti.N				
Ir.	7A-13 PbBi <sub>3</sub> Ti <sub>2</sub> N		mbac t	nsition was reported by Subbarao in 1961.	4404-

lb	phase	II		1			
	state			P			
	crystal system	pseudo-tetrage	onal	tetragonal			
	Θ			) °C			61515
	a = 3.687  Å, c =	= 33.55 Å at RT					61515
Vr.	7A-14 BaBi,Ti,C	_					
a	Dielectric anom	alv. accociated uni	Io) 111	nase transition was 1961. Ferroelect	as reported inder ric activity was	endently by reported in-	*)61S15 *)61S11 *)61F7
ъ	phase	ı II	,	, I			
	state	F		P			61F7
	crystal system	orthorho (or pseudo-ort		nbic) tetrago	nal		
	Θ			375 °C 395∗) °C			*)61S15
		a = 1.000, c = 4	1.85 Å	at RT.			62515
3	Crystal structur			- A DT			
ja —	$\kappa = C/(T - \Theta_{\rm p})$	ant: Fig. 891. $\kappa$ ), $C = 2.5 \cdot 10^5$	K, Op	= 335 °C.			61515
7a	Piezoelectric con	$nstant: d_{23} = 2.3$	3 · 10-1	¹ C N−¹.			62517
7	rab. 105. BaBi Ti compariso	O <sub>15</sub> , Ba <sub>2</sub> Bi <sub>4</sub> Ti <sub>5</sub> O n with those of I	18, Bi <sub>4</sub> 1 BaTiO <sub>3</sub>	$\begin{bmatrix} i_s O_{1g}, Ba Ti O_s \end{bmatrix} \begin{bmatrix} t_s = t_{\infty} \end{bmatrix}$	or comparison). $\exp(+\alpha/E), t_{\rm s} =$	= switching ti	me
7	rab. 105. BaBi Ti compariso	n with those of l	BaTiO <sub>3</sub>	$[62FI]. \ t_{\rm s} = t_{\infty}$	$\exp(+\alpha/\mathcal{L}), t_{\rm g} =$	= switching ti	me
7	rab. 105. BaBi <sub>t</sub> Ti compariso	BaTiO <sub>3</sub> Bi <sub>4</sub> T	i <sub>3</sub> O <sub>12</sub>	$[62F1]. \ t_s = t_{\infty}$ $BaBi_4Ti_4O_{15}$	$\exp(+\alpha/\mathcal{L}), t_8 =$ $Ba_9Bi_4Ti_5O_{18}$	= switching ti	me
1	compariso	m with those of I  BaTiO <sub>3</sub> $Bi_4T$ 6.1 41	BaTiO <sub>3</sub> 'i <sub>3</sub> O <sub>12</sub>	$\begin{bmatrix} 62FI \end{bmatrix}.  t_s = t_{\infty}$ $BaBi_4Ti_4O_{15}$ $23$	$\frac{\exp(+\alpha/L)}{\operatorname{Ba}_{2}\operatorname{Bi}_{4}\operatorname{Ti}_{5}\operatorname{O}_{18}}$	105 V m <sup>-1</sup>	me
	compariso $\frac{\alpha}{t_{\infty}}$ 7A-15 PbBi <sub>4</sub> Ti <sub>4</sub>	$\begin{array}{c c} \text{n with those of I} \\ \hline \text{BaTiO}_3 & \text{Bi}_4\text{T} \\ \hline & 6.1 & 41 \\ \hline & 0.4 & 10 \\ \hline \text{O}_{15} \\ \end{array}$	BaTiO <sub>3</sub>	$ \begin{array}{c c} [62FI]. & t_8 = t_{\infty} \\  & \text{BaBi}_4 \text{Ti}_4 \text{O}_{15} \\ \hline  & 23 \\ \hline  & 1.5 \end{array} $	$\frac{\exp(+\alpha/L), i_{6}}{\operatorname{Ba}_{2}\operatorname{Bi}_{4}\operatorname{Ti}_{5}\operatorname{O}_{18}}$ $\frac{76}{10^{-2}}$	10° V m <sup>-1</sup> μ sec	inc
Ŋr.	compariso $\frac{\alpha}{t_{\infty}}$ 7A-15 PbBi <sub>4</sub> Ti <sub>4</sub>	$\begin{array}{c c} \text{n with those of I} \\ \hline \text{BaTiO}_3 & \text{Bi}_4\text{T} \\ \hline & 6.1 & 41 \\ \hline & 0.4 & 10 \\ \hline \text{O}_{15} \\ \end{array}$	BaTiO <sub>3</sub>	$ \begin{array}{c c} [62FI]. & t_8 = t_{\infty} \\  & \text{BaBi}_4 \text{Ti}_4 \text{O}_{15} \\ \hline  & 23 \\ \hline  & 1.5 \end{array} $	$\frac{\exp(+\alpha/L)}{\operatorname{Ba}_{2}\operatorname{Bi}_{4}\operatorname{Ti}_{5}\operatorname{O}_{18}}$	10° V m <sup>-1</sup> μ sec	61S15
Ŋr.	compariso $\frac{\alpha}{t_{\infty}}$ 7A-15 PbBi <sub>4</sub> Ti <sub>4</sub>	$\begin{array}{c c} \text{n with those of I} \\ \hline \text{BaTiO}_3 & \text{Bi}_4\text{T} \\ \hline & 6.1 & 41 \\ \hline & 0.4 & 10 \\ \hline \text{O}_{15} \\ \end{array}$	BaTiO <sub>3</sub>	$ \begin{array}{c c} [62FI]. & t_8 = t_{\infty} \\  & \text{BaBi}_4 \text{Ti}_4 \text{O}_{15} \\ \hline  & 23 \\ \hline  & 1.5 \end{array} $	$\frac{\exp(+\alpha/L), i_{6}}{\operatorname{Ba}_{2}\operatorname{Bi}_{4}\operatorname{Ti}_{5}\operatorname{O}_{18}}$ $\frac{76}{10^{-2}}$	10° V m <sup>-1</sup> μ sec	inc
Nr. la	compariso  α  t <sub>∞</sub> 7A-15 PbBi <sub>4</sub> Ti <sub>4</sub> Dielectric anoma	$\begin{array}{c c} \text{n with those of I} \\ \hline \text{BaTiO}_3 & \text{Bi}_4\text{T} \\ \hline 6.1 & 41 \\ \hline 0.4 & 10 \\ \hline 0_{15} \\ \hline \text{aly associated with} \end{array}$	BaTiO <sub>3</sub>	$[62FI]. \ t_{8} = t_{\infty}$ $BaBi_{4}Ti_{4}O_{15}$ $23$ $1.5$ se transition was	$\frac{\exp(+\alpha/L), i_{6}}{\operatorname{Ba}_{2}\operatorname{Bi}_{4}\operatorname{Ti}_{5}\operatorname{O}_{18}}$ $\frac{76}{10^{-2}}$	10° V m <sup>-1</sup> μ sec	inc
Nr. la	compariso  α  t <sub>∞</sub> 7A-15 PbBi <sub>4</sub> Ti <sub>4</sub> Dielectric anomaphase	BaTiO <sub>3</sub> Bi <sub>4</sub> T  6.1 41  0.4 10  O <sub>15</sub> ally associated with orthorhombic (possibly)	3aTiO <sub>3</sub> (i <sub>3</sub> O <sub>12</sub> ()-2 ()-2 () tet	[62F1]. $t_8 = t_{\infty}$ BaBi <sub>4</sub> Ti <sub>4</sub> O <sub>15</sub> 23  1.5  se transition was 1	$\frac{\exp(+\alpha/L), i_{6}}{\operatorname{Ba}_{2}\operatorname{Bi}_{4}\operatorname{Ti}_{5}\operatorname{O}_{18}}$ $\frac{76}{10^{-2}}$	10° V m <sup>-1</sup> μ sec	inc
Nr. la	compariso $ \frac{\alpha}{t_{\infty}} $ 7A-15 PbBi <sub>4</sub> Ti <sub>4</sub> Dielectric anomation phase state  crystal system $ \theta $ $ a = 6.6 \cdot 10^{-3} \text{ k} $	No with those of F	i <sub>3</sub> O <sub>12</sub> i <sub>3</sub> O <sub>12</sub> chapha tet		$\frac{\exp(+\alpha/L), i_{6}}{\operatorname{Ba}_{2}\operatorname{Bi}_{4}\operatorname{Ti}_{5}\operatorname{O}_{18}}$ $\frac{76}{10^{-2}}$	10° V m <sup>-1</sup> μ sec	61S15 61S15
Nr. la	compariso $ \frac{\alpha}{t_{\infty}} $ 7A-15 PbBi <sub>4</sub> Ti <sub>4</sub> Dielectric anomal phase state  crystal system $ \Theta $ $ \varrho = 6.6 \cdot 10^{-3} \text{ A} $ $ a = 5.437 \text{ Å}, b$	m with those of I  BaTiO <sub>3</sub> Bi <sub>4</sub> T  6.1 41  0.4 10  O <sub>15</sub> ally associated with orthorhombic (possibly)  57 $a = 1.000, c = 4$	BaTiO <sub>3</sub> i <sub>3</sub> O <sub>12</sub> i <sub>3</sub> O <sub>12</sub> chapha tet 0° °C	$[62FI]. \ t_s = t_{\infty}$ $BaBi_4Ti_4O_{15}$ $23$ $1.5$ se transition was: $I$ $P$ $Tagonal$ at RT.	$\frac{\exp(+\alpha/L), i_{6}}{\operatorname{Ba}_{2}\operatorname{Bi}_{4}\operatorname{Ti}_{5}\operatorname{O}_{18}}$ $\frac{76}{10^{-2}}$	10° V m <sup>-1</sup> μ sec	61S15 61S15 62S15
Nr. 1a b	compariso $\frac{\alpha}{t_{\infty}}$ 7A-15 PbBi <sub>4</sub> Ti <sub>4</sub> Dielectric anomy phase state  crystal system $\theta$ $\theta = 6.6 \cdot 10^{-3} \text{ l}$ $a = 5.437 \text{ Å}, b$ Dielectric const $x = C/(T - \theta)$	m with those of F  BaTiO <sub>3</sub> Bi <sub>4</sub> T  6.1 41  0.4 10  O <sub>15</sub> aly associated with orthorhombic (possibly)  57  ag m <sup>-3</sup> a = 1.000, $c = 4$ ant: Fig. 893. $\times$ a), $C = 1.4 \cdot 10^5$	BaTiO <sub>3</sub> i <sub>3</sub> O <sub>12</sub> i <sub>3</sub> O <sub>12</sub> chapha tet 0°C 41.35 Å c = 220°C, Θ <sub>p</sub>	$[62FI]. \ t_s = t_{\infty}$ $BaBi_4Ti_4O_{15}$ $23$ $1.5$ $se transition was the property of the $	$\frac{\exp(+\alpha/L), i_{6}}{\operatorname{Ba}_{2}\operatorname{Bi}_{4}\operatorname{Ti}_{5}\operatorname{O}_{18}}$ $\frac{76}{10^{-2}}$	10° V m <sup>-1</sup> μ sec	61S15 61S15 62S15 61S15 62S17
Nr. la b	compariso $\frac{\alpha}{t_{\infty}}$ 7A-15 PbBi <sub>4</sub> Ti <sub>4</sub> Dielectric anomy phase state  crystal system $\theta$ $\theta = 6.6 \cdot 10^{-3} \text{ l}$ $a = 5.437 \text{ Å}, b$ Dielectric const $x = C/(T - \theta)$	BaTiO <sub>3</sub>   Bi <sub>4</sub> T     BaTiO <sub>3</sub>   Bi <sub>4</sub> T     6.1   41     0.4   10     O <sub>15</sub>     aly associated with     orthorhombic (possibly)     57     tg m <sup>-3</sup>     a = 1.000, c = 4     ant. Fig. 893   8	BaTiO <sub>3</sub> i <sub>3</sub> O <sub>12</sub> i <sub>3</sub> O <sub>12</sub> chapha tet 0°C 41.35 Å c = 220°C, Θ <sub>p</sub>	$[62FI]. \ t_s = t_{\infty}$ $BaBi_4Ti_4O_{15}$ $23$ $1.5$ $se transition was the property of the $	$\frac{\exp(+\alpha/L), i_{6}}{\operatorname{Ba}_{2}\operatorname{Bi}_{4}\operatorname{Ti}_{5}\operatorname{O}_{18}}$ $\frac{76}{10^{-2}}$	10° V m <sup>-1</sup> μ sec	61S15 61S15 62S15 61S15
Nr. 1a b	compariso $\alpha$ $t_{\infty}$ 7A-15 PbBi <sub>4</sub> Ti <sub>4</sub> Dielectric anomorphase  state  crystal system $\Theta$ $\varrho = 6.6 \cdot 10^{-3}$ if $\alpha = 5.437$ Å, b)  Dielectric const $\alpha = C/(T - \Theta)$ Piezoelectric co.  7A-16 SrBi <sub>4</sub> Ti <sub>4</sub>	m with those of F  BaTiO <sub>3</sub> Bi <sub>4</sub> T  6.1 41  0.4 10  O <sub>15</sub> aly associated with orthorhombic (possibly)  57  ag m <sup>-3</sup> a = 1.000, c = 4  cant: Fig. 893. ×  co), C = 1.4 · 105  constant: $d_{33} = 2$ .  O <sub>15</sub>	BaTiO <sub>3</sub> $(i_3O_{12})$ $(i_3O$	$[62FI]. \ t_s = t_{\infty}$ $BaBi_4Ti_4O_{15}$ $23$ $1.5$ se transition was: $\frac{I}{P}$ ragonal $at \ RT.$ $0 \ at \ RT.$ $= 552 \ ^{\circ}C.$ $^{11} \ C \ N^{-1}.$	$\frac{\text{Ba}_{2}\text{Bi}_{4}\text{Ti}_{5}\text{O}_{18}}{76}$ $\frac{76}{10^{-2}}$ reported by Subb	10 <sup>5</sup> V m <sup>-1</sup> μ sec	61S15 61S15 62S15 61S15 62S17 62S17
Nr. 1a b	compariso $\frac{\alpha}{t_{\infty}}$ 7A-15 PbBi <sub>4</sub> Ti <sub>4</sub> Dielectric anomorphase  state  crystal system $\theta$ $\varrho = 6.6 \cdot 10^{-3} \text{ I}$ $a = 5.437 \text{ Å}, b/$ Dielectric const $\kappa = C/(T - \theta)$ Piezoelectric co. 7A-16 SrBi <sub>4</sub> Ti <sub>4</sub> Dielectric anomorphise	m with those of F  BaTiO <sub>3</sub> Bi <sub>4</sub> T  6.1 41  0.4 10  O <sub>15</sub> ally associated with orthorhombic (possibly)  57 $a = 1.000, c = 4$ $a = 1.000, c = 4$ $a = 1.4 \cdot 10^5$ onstant: $d_{33} = 2.5$ O <sub>15</sub> ally associated with orthorhombic (possibly)  ally associated with orthorhombic (possibly)	BaTiO <sub>3</sub> $(i_3O_{12})$ $(i_3O$	$[62FI]. \ t_s = t_{\infty}$ $BaBi_4Ti_4O_{15}$ $23$ $1.5$ se transition was: $I$ $P$ $Tagonal$ $at RT.$ $2 at RT.$ $552 ^{\circ}C.$ $11 C N^{-1}.$ ase transition was	$\frac{\exp(+\alpha/L), i_{6}}{\operatorname{Ba}_{2}\operatorname{Bi}_{4}\operatorname{Ti}_{5}\operatorname{O}_{18}}$ $\frac{76}{10^{-2}}$	10 <sup>5</sup> V m <sup>-1</sup> μ sec	61S15 61S15 62S15 61S15 62S17 62S17
Nr. 1a b	compariso $\frac{\alpha}{t_{\infty}}$ 7A-15 PbBi <sub>4</sub> Ti <sub>4</sub> Dielectric anomorphase  state  crystal system $\theta$ $\varrho = 6.6 \cdot 10^{-3} \text{ I}$ $a = 5.437 \text{ Å, b}$ Dielectric const $x = C/(T - \theta)$ Piezoelectric anomorphase	m with those of F  BaTiO <sub>3</sub> Bi <sub>4</sub> T  6.1 41  0.4 10  O <sub>15</sub> aly associated with orthorhombic (possibly)  57  ag m <sup>-3</sup> a = 1.000, c = 4  cant: Fig. 893. ×  co), C = 1.4 · 105  constant: $d_{33} = 2$ .  O <sub>15</sub>	BaTiO <sub>3</sub> $(i_3O_{12})$ $(i_3O$	$[62FI]. \ t_s = t_{\infty}$ $BaBi_4Ti_4O_{15}$ $23$ $1.5$ se transition was: $I$ $P$ $Tagonal$ $at RT.$ $0 at RT.$ $= 552 ^{\circ}C.$ $U C N^{-1}.$ as e transition was: $I$	$\frac{\text{Ba}_{2}\text{Bi}_{4}\text{Ti}_{5}\text{O}_{18}}{76}$ $\frac{76}{10^{-2}}$ reported by Subb	10 <sup>5</sup> V m <sup>-1</sup> μ sec	61S15 61S15 62S15 61S15 62S17 62S17
Nr. 1a b 5a 7a Nr	compariso $\frac{\alpha}{t_{\infty}}$ 7A-15 PbBi <sub>4</sub> Ti <sub>4</sub> Dielectric anomorphase  state  crystal system $\theta$ $\varrho = 6.6 \cdot 10^{-3} \text{ I}$ $a = 5.437 \text{ Å}, b/$ Dielectric const $\kappa = C/(T - \theta)$ Piezoelectric co. 7A-16 SrBi <sub>4</sub> Ti <sub>4</sub> Dielectric anomorphise	m with those of F  BaTiO <sub>3</sub> Bi <sub>4</sub> T  6.1 41  0.4 10  O <sub>15</sub> ally associated with orthorhombic (possibly)  57 $a = 1.000, c = 4$ $a = 1.000, c = $	BaTiO <sub>3</sub> $f_{i_2O_{12}}$ $f_{$	$[62FI]. \ t_s = t_{\infty}$ $BaBi_4Ti_4O_{15}$ $23$ $1.5$ se transition was: $I$ $P$ $Tagonal$ $at RT.$ $2 at RT.$ $552 ^{\circ}C.$ $11 C N^{-1}.$ ase transition was	$\frac{\text{Ba}_{2}\text{Bi}_{4}\text{Ti}_{5}\text{O}_{18}}{76}$ $\frac{76}{10^{-2}}$ reported by Subb	10 <sup>5</sup> V m <sup>-1</sup> μ sec	61S15 61S15 62S15 61S15 62S17 62S17
Nr. 1a b	compariso $\frac{\alpha}{t_{\infty}}$ 7A-15 PbBi <sub>4</sub> Ti <sub>4</sub> Dielectric anomomorphase state crystal system $\theta$ $\varrho = 6.6 \cdot 10^{-3} \text{ l}$ $a = 5.437 \text{ Å, b}$ Dielectric const $x = C/(T - \theta)$ Piezoelectric const $x = C/(T - \theta)$ Piezoelectric const $x = C/(T - \theta)$ Piezoelectric anomomomorphase state crystal system	m with those of F  BaTiO <sub>3</sub> Bi <sub>4</sub> T  6.1 41  0.4 10  O <sub>15</sub> ally associated with orthorhombic (possibly)  57 $a = 1.000, c = 4$ $a = 1.000, c = $	3aTiO <sub>3</sub> i <sub>2</sub> O <sub>12</sub> chapha tet co °C 41.35 Å c= 220 °C, Øp 3 · 10	$[62FI]. \ t_s = t_{\infty}$ $BaBi_4Ti_4O_{15}$ $23$ $1.5$ se transition was: $I$ $P$ ragonal  at RT. $0 \text{ at RT.}$ $= 552 \text{ °C.}$ $u \text{ C N}^{-1}$ use transition was: $I$ $P$	$\frac{\text{Ba}_{2}\text{Bi}_{4}\text{Ti}_{5}\text{O}_{18}}{76}$ $\frac{76}{10^{-2}}$ reported by Subb	10 <sup>5</sup> V m <sup>-1</sup> μ sec	61S15 61S15 62S15 61S15 62S17 62S17
Nr. 1a b 5a 7a Nr	compariso $\frac{\alpha}{t_{\infty}}$ 7A-15 PbBi <sub>4</sub> Ti <sub>4</sub> Dielectric anomality phase state  crystal system $\theta$ $\varrho = 6.6 \cdot 10^{-3} \text{ k}$ $a = 5.437 \text{ Å}, b/$ Dielectric const $\kappa = C/(T - \theta)$ Piezoelectric const $\kappa = C/(T - \theta)$ Piezoelectric anomality phase state  crystal system $\theta$ $\rho = 5.2 \cdot 10^{3} \text{ kg}$	m with those of F  BaTiO <sub>3</sub> Bi <sub>4</sub> T  6.1 41  0.4 10  O <sub>15</sub> ally associated with orthorhombic (possibly)  57 $a = 1.000, c = 4$ $a = 1.000, c = $	BaTiO <sub>3</sub> $i_3O_{12}$ $i_3O_{12}$ $i_3O_{12}$ $i_3O_{12}$ $i_4O_{12}$ $i_4O_{13}$ $i_4O_{12}$ $i_5O_{12}$ $i_5O_{1$	$[62FI]. \ t_s = t_{\infty}$ $BaBi_4Ti_4O_{15}$ $23$ $1.5$ se transition was: $I$ $P$ $Tagonal$ at RT. $= 552 ^{\circ}C.$ $U C N^{-1}.$ $I$ $P$ $Tagonal$ $I$	$\frac{\text{Ba}_{2}\text{Bi}_{4}\text{Ti}_{5}\text{O}_{18}}{76}$ $\frac{76}{10^{-2}}$ reported by Subb	10 <sup>5</sup> V m <sup>-1</sup> μ sec	61S15 61S15 62S15 61S15 62S17 62S17
Nr.  1a b  5a Nr  1a	compariso $\frac{\alpha}{t_{\infty}}$ 7A-15 PbBi <sub>4</sub> Ti <sub>4</sub> Dielectric anomation phase state  crystal system $\theta$ $\varrho = 6.6 \cdot 10^{-3} \text{ k}$ $a = 5.437 \text{ Å, } b/$ Dielectric const $\kappa = C/(T - \theta)$ Piezoelectric const $\kappa = C/(T - \theta)$ $\kappa = 5.428 \text{ Å, } b/$ Dielectric const	m with those of F  BaTiO <sub>3</sub> Bi <sub>4</sub> T  6.1 41  0.4 10  O <sub>15</sub> ally associated with a sociated with the second of the	BaTiO <sub>3</sub> $i_3O_{12}$ $i_3O_{12}$ $i_3O_{12}$ $i_3O_{12}$ $i_4O_{12}$ $i_4O_{13}$ $i_4O_{12}$ $i_5O_{12}$ $i_5O_{1$	BaBi <sub>4</sub> Ti <sub>4</sub> O <sub>15</sub> BaBi <sub>4</sub> Ti <sub>4</sub> O <sub>15</sub> 23  1.5  se transition was:  I P ragonal  at RT.  at RT.  552 °C.  C N <sup>-1</sup> ragonal  tat RT.  as transition was  I P tragonal	$\frac{\text{Ba}_{2}\text{Bi}_{4}\text{Ti}_{5}\text{O}_{18}}{76}$ $\frac{76}{10^{-2}}$ reported by Subb	10 <sup>5</sup> V m <sup>-1</sup> μ sec	61S15 61S15 62S15 61S15 62S17 62S17 61S15

Nr. 7A-	17 CaBi <sub>e</sub> Ti <sub>e</sub>	O <sub>15</sub>				
1a Ca	aBi <sub>4</sub> Ti <sub>4</sub> O <sub>15</sub> wa o dielectric as	s investigated by S nomaly has been de	SUBBARAO in 1962.		62517	
b O	Orthorhombic: $a = 5.418 \text{ Å}$ , $b/a = 1.002$ , $c = 40.75 \text{ Å}$ at RT. $\varrho = 4.7 \cdot 10^3 \text{ kg m}^{-3}$ .					
		tant: Fig. 895. ×=	= 120 at RT.		61511	
Nr. 7A-	18 Bi <sub>5</sub> Ti <sub>2</sub> Ga	O <sub>15</sub>			1 0.0	
1a Bi	Ti <sub>3</sub> GaO <sub>15</sub> wa	is investigated by	SUBBARAO in 1962.			
b Or	thorhombic:	nomaly has been de $a = 5.408 \text{ Å}$ , $b/a =$	etected. = $1.006$ , $c = 41.05$ Å at RT.		62S17 62S15	
<u> </u>	= 1.3 . 10 KG	$m^{-3}$ . ant: $\kappa = 150$ at R'				
	19 Ba <sub>z</sub> Bi <sub>t</sub> Ti <sub>s</sub>		••		62817	
1a Fe	aroelectric ac		O <sub>18</sub> was observed by Aurivi	LLIUS in 1962.	62A 5	
sta	ase		<u>I</u>			
	stal system		P			
9	seer system	orthorhombic   325 °	tetragonal			
1 -	- 5 527 Å b.	,+	_		62A5	
		= 5.514  Å, c = 50.3			6315	
		e: Fig. 896; Tab. 1			-	
			parameter: Fig. 897.		<u>                                     </u>	
×	electric consta = 360, x'' =	22 at RT.			62A 5	
c Re Co	manent polar ercive field: <i>I</i>	ization: $P_r = 2 \cdot 10^{\circ}$ V m <sup>-</sup>	0-3 C m-3 at RT. 1 at RT.		62A5	
4b Sw	ritching: see I	Fig. 892; Tab. 105.			·	
		Tab. 106. Ba <sub>2</sub> Bi <sub>4</sub> [62A5]. Sp	Ti <sub>5</sub> O <sub>18</sub> . Fractional coordina ace group of I4/mmm was as	ites of atoms	•	
		I4/mmm	(0, 0, 0; 1/2, 1/2, 1/2) +			
		4 Bi in 4(e): 4 (Bi, Ba) in 4(e): 4 (Bi, Ba) in 4(e): 2 Ti in 2(b): 4 Ti in 4(e): 4 Ti in 4(e): 4 O in 4(c): 4 O in 4(d):	±0, 0, z: ±0, 0, 1/2 0, 1/2, 0; 1/2, 0, 0 0, 1/2, 1/4; 1/2, 0, 1/4	z = 0.2255 $z = 0.0420$ $z = 0.1300$ $z = 0.3370$ $z = 0.4185$		
Nr. 7A-2		4 O in 4(e): 4 O in 4(e): 4 O in 4(e): 8 O in 8(g): 8 O in 8(g):	$\pm (0, 1/2, z; 1/2, 0, z)$	$   \begin{array}{c}     z = 0.2962 \\     z = 0.3378 \\     z = 0.4593 \\     z = 0.0815 \\     z = 0.1630   \end{array} $		
b pha	roelectric act		18 was observed by Subbara	NO in 1962.	62517	
1		II				
cry	stal system	orthorhombic	P tetragonal			
0		(possibly) 310 °C	tetragonal		62517	
ρ=	- 6.6 • 10° kg	m-3,			62517	
a =	= 5.461 Å, b/a	= 1.000, c = 49.76	Å at RT.		62S15	

	_		II 7 Laye	r-stru	cture oxides	F	igures p. 380ff
5a	Dielectric consta	int: Fig. 899.	κ = 400 at 1	RT.			62517
	$\kappa = C/(T - \Theta_p), C = 4.1 \cdot 10^5 \text{ °K}, \Theta_p = 280 \text{ °C}.$					62517	
С_							62517
7a.	Piezoelectric con	$a_{33}=2$	.5 · 10-4 C r	ų —·.			1 02317
Nr.	7A-21 Sr <sub>2</sub> Bi <sub>4</sub> Ti <sub>5</sub> (	O <sub>18</sub>					
1a	Ferroelectric ac	tivity in Sr.Bi.	Ti,O <sub>18</sub> was o	bserv	ed by Subbai	rao in 1962.	62517
ь	phase	II I	ļ I				
	state	F	P				
	crystal system	orthorhombic (possibly)	tetrago	nal			
	Θ	2	85 °C				62517
	$\varrho = 5.3 \cdot 10^{2} \text{ kg}$ a = 5.461  Å, b/c	$m^{-3}$ . $a = 1.000, c =$	48.80 Å at 1	RT.			62515
5a	Dielectric const. $\kappa = C/(T - \Theta_p)$	ant: Fig. 900. ), $C = 0.47 \cdot 10$	$\kappa = 280 \text{ at } 10^{5} \text{ °K}, \Theta_{p} = 10^{10} \text{ or } 10^{1$	RT. 255 °C	<b>C</b> .		62517
С	Spontaneous po						62517
7a	Piezoelectric co						62517
NY.	′ 7A-22 Bi₂Ti₄O <sub>11</sub>						
			with a phase	trans	sition was ob	served in Bi <sub>2</sub> Ti <sub>4</sub> O <sub>11</sub> by	
1a	Subbarao in 19		with a phase	- 11011		,or , our = -1 = -1 = -1	62516
b	phase	Į III	II		I		65]4
	crystal system	monoclinic	monocl	inic			
	space group	C2/c-C <sub>2h</sub>	C2/m-4	Can can			
	0	. <del> </del>	250°)	120	)Oa) °C		a)62S16
	$\varrho = (6.12 \pm 0.02) \cdot 10^3 \text{ kg m}^{-3}.$ $a = (14.612 \pm 0.006) \text{ Å}, b = (3.799 \pm 0.004) \text{ Å}, c = (14.946 \pm 0.006) \text{ Å},$						65]4 65]4
L	$\beta = (93.13 \pm 0)$				) TTY 72'	- 001 000 Tab 107	CSTA
3						65]4	
4	Thermal expans						-
5a	Dielectric const			_		••	(251)
c	No hysteresis lo	oops could be o	btained betv	veen 2	5 °C and 290	ა.	62516
		Tab. 107.	Bi <sub>g</sub> Ti <sub>g</sub> O <sub>11</sub> . A	tomic	parameters	at RT [65]4]	
		Atom	x		у	z	
	0(1	)   0.0		0.26	2 + 0.012	0.250	

Atom	x	у	z
O(1) O(2) O(3) O(4) O(5) O(6) Ti(1) Ti(2) Bi	0.0 0.1828 ± 0.0024 0.1408 ± 0.0024 0.0814 ± 0.0024 0.2662 ± 0.0024 0.0546 ± 0.0024 0.0530 ± 0.0006 0.1461 ± 0.0006 0.3211 ± 0.00015	0.262 ± 0.012 0.246 ± 0.007 0.256 ± 0.007 0.760 ± 0.007 0.747 ± 0.007 0.770 ± 0.007 0.250 ± 0.002 0.759 ± 0.002 0.1747 ± 0.0005	0.250 0.2207 ± 0.0024 0.0338 ± 0.0024 0.1259 ± 0.0024 0.0880 ± 0.0024 0.9221 ± 0.0024 0.1406 ± 0.0006 0.0162 ± 0.0006 0.1798 ± 0.00015

Thermal parameter  $B=0.33~{\rm \AA}^2$  for all atoms. Coordinates and standard deviations in cell fractions.

## 7B Complex compounds and solid solutions

Nr. 7B-1 Bi	Me2+Ti	$-$ <sub>2</sub> $Nb_{1+2}$	Ο, (	$Me^{s+} =$	Ba,	St, Pb)	
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Lattice parameter: Fig. 905. Transition temperature: Fig. 906. 1b Dielectric constant: Fig. 907.

Nr. 7B-2  $Bi_{4-x}Me_x^2+Ti_{3-x}Nb_xO_{12}$  (Me<sup>2+</sup> = Ba, Sr, Pb)

Lattice parameter: Fig. 908. Transition temperature: Fig. 909. Dielectric constant: Fig. 910.

\* The unit cell of phase II has about half the volume of the unit cell of phase III.

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5	E	3
4	$\geq$	A
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(	Best	)
C	2	)

. 1	7B-3 Na <sub>0.5</sub> Bi <sub>4.5</sub> T		th a phase transi	tion was reported by SUBBARAO	in 62S17		
a	1962.	ny associated wi	un a pinac u unu	acon was reported by a comment			
ъ	phase	II	I		ł		
	state		P				
	crystal system	orthorhombic	tetragonal				
	Θ	650	.€		62517		
	$e = 6.3 \cdot 10^{8} \text{ kg}$ a = 5.427  Å, b/a	$m^{-3}$ . = 1.006, $c = 40$	).65 Å at RT.		62515		
ia	Dielectric consta $\kappa = C/(T - \Theta_p)$	nt: Fig. 911. x , C = 0.79 · 10 <sup>5</sup>	= 200 at RT. °K, $\Theta_p = 610$ °C		62517		
'a		$stant: d_{33} = 1.0$			62517		
· T		_					
Vr.	7B-4 K <sub>0.8</sub> Bi <sub>4.5</sub> Ti <sub>4</sub>			11	:- 62517		
a	Dielectric anoma 1962.	lly associated wi	th a phase transi	tion was reported by SUBBARAO	in 62S17		
ъ	phase	II	1				
	state		P				
	crystal system	orthorhombic	tetragonal				
	Θ	550	) °C		62517		
	$\varrho = 6.7 \cdot 10^3 \text{ kg m}^{-3}$ . $\alpha = 5.440 \text{ Å}, b/a = 1.004, c = 41.15 \text{ Å at RT}$ .						
ā	Dielectric constant: Fig. 912. $\kappa = 140$ at RT. $\kappa = C/(T - \Theta_p)$ , $C = 0.74 \cdot 10^5$ °K, $\Theta_p = 515$ °C.						
7a	Piezoelectric constant: $d_{13} = 1.0 \cdot 10^{-11} \text{ C N}^{-1}$ .						
	•			O <sub>s</sub> 1b   Transition temper	ature: Fig. 913.		
Nr.	7B-5 (Pb <sub>1-x</sub> Ba <sub>x</sub> )	PINDSO SIIG (1	. D1-E312/D181408	5 Dielectric constan			
Nr.	7B-6 (1-x)Bi <sub>4</sub> Ti <sub>2</sub>	O <sub>13</sub> - xBaTiO <sub>3</sub>		5   Transition temper	ature: Fig. 915.		
	7B-7 Bi <sub>4+x</sub> Pb <sub>1-x</sub>						
	A nother formula	for this solid so	olution is $(1 - x)$	PbBi <sub>s</sub> Ti <sub>s</sub> O <sub>15</sub> · zBi <sub>s</sub> Ti <sub>s</sub> GaO <sub>15</sub> . Pr	ор-		
1a	erties of this sol	id solution were	studied by Subs	ARAO in 1962.	62S17		
b	x = 0.25:		_		20547		
	phase	II	I	<del></del>	62517		
	state		P				
	crystal system	orthorhomb (pseudo-tetrag	onal) tetrage	onal			
	€ 600 °C						
	Pseudo-tetragonal cell parameter: $a = 3.842 \text{ Å}$ , $c = 41.40 \text{ Å}$ at RT. Dielectric constant: $x = 180$ at RT; $x = 3035$ at $\Theta$ .						
	x = 0.5:						
	phase	II	I		62517		
	state		P		1		
	crystal system	orthorhomi (pseudo-tetrag		onal			
		(pseudo-tetragonal)					
	θ		620 °C	c = 41.40 Å at RT.			